

# APPARATUS AND METHOD FOR PULMONARY VENTILATION OF A PATIENT CONCURRENT WITH FIBEROPTIC RESPIRATORY TRACT EXAMINATION AND TRACHEAL INTUBATION

## THE BACKGROUND OF THE INVENTION

Intubation of the trachea (in animals) was described as early as 1543. The first attempts in humans, starting in the early 1700's were made, for resuscitation of drowning victims. Later efforts starting in 1858 were made to prevent aspiration pneumonia in surgery of the upper air-passages under local anesthesia. The first intubation under general anesthesia was performed in 1878.

Improvements in equipment and techniques followed, especially during and after World War I, when plastic surgery and jaw injuries made endotracheal anesthesia mandatory for proper control of the patient's airway under general anesthesia.

The introduction of curare in 1942, for muscle relaxation under general anesthesia, increased the incidence of hypoventilation and apnea, and necessitated the development of intermittent positive pressure ventilation to deal with these problems. The advent of mechanical ventilators made the use of endotracheal tubes obligatory.

Endotracheal anesthesia is now standard and accepted practice for all major surgery under general anesthesia. It provides much safer anesthesia for the patient and greatly improves operating conditions for the surgeon.

In spite of the many advances in techniques and equipment, however, certain patients, classed as 'THE DIFFICULT INTUBATION' or 'THE DIFFICULT AIRWAY' present themselves from time to time both in the elective and in the emergency situation. They are the nightmare of every practitioner and for some their 'Waterloo'.

In a recent article in the Journal of American Medical Association (253.16), April 26, 1985, Keenan and Bogan cite failure to ventilate the patient as responsible for half of the cases of cardiac arrest under anesthesia. The causes for failure to ventilate include failure to adequately ventilate by mask or after improper intubation (esophageal or right mainstem bronchus), and inability to intubate or ventilate.

The causes of 'DIFFICULT INTUBATION' are many, including:

- (1) Tumors of the vocal cords or nearby structures.
- (2) Large, floppy epiglottis; acute epiglottitis; epiglottic tumor.
- (3) Large, thick tongue, tumors of the tongue, enlarged tonsils.
- (4) Submandibular abscess; pharyngeal abscess (Ludwig's Angina).
- (5) Extreme obesity.
- (6) Short, muscular neck; thyroid enlargement; cystic hygroma.
- (7) Burn contractures of the neck.
- (8) Long, high-arched palate associated with a long, narrow mouth.
- (9) Increased alveolar-mental distance which necessitates wide opening of the mandible for laryngoscopy.
- (10) Inadequate relaxation under anesthesia with inability to open mouth widely.
- (11) Mandibular problems include: Short mandible (mandibular hypoplasia with receding jaw and obtuse mandibular angles); degenerative arthritis and ankylosis

of the temporomandibular joint with inability to open the mouth widely (poor mobility of the mandible).

(12) Dental problems include: Loose or snaggy teeth; prominent large teeth (usually a full set); protruding upper incisor teeth associated with relative overgrowth of the premaxilla; dental malocclusion.

(13) Spinal problems include: Limited mobility of the head and neck due to ankylosing spondylitis; degenerative arthritis; fractured cervical with spinal cord injury (either actual or potential) (e.g. cord compression, etc.); patients in 'HALO' traction.

(14) 'Anterior Glottis'; small glottic opening; laryngeal edema.

(15) Tracheal stenosis; undersized trachea; tracheoesophageal fistula (in adults).

(16) Pneumothorax.

(17) Thoracic aortic aneurysm.

During difficult intubations under routine laryngoscopy in elective surgical patients or in the emergency situation, when all else has failed, the harried anesthesiologists, at last, think of the flexible fiberoptic scope (FSS), but, owing to lack of experience and an effective ventilating/intubating airway is frequently unable to use the fiberoptic device properly. Added to this is the fact that frequent suctioning of secretions and/or blood from the oropharynx resulting from difficult routine laryngoscopy leads to unwanted interruption of ventilation which may have deleterious effects (such as hypoxemia) if persisted in too long.

The expensive fiberoptic device may then be thrust aside in disgust. Too bad, because it's an extremely useful instrument. Previous practice with the fiberoptic ventilating airway and the fiberoptic scope could have turned the failures into enthusiastic successes.

In an effort to solve the problems of the 'DIFFICULT INTUBATION' various devices and techniques have been developed over the years: laryngoscopes of different sizes and shapes, prisms, intubating airways, tube introducers, controllable-tip endotracheal tubes, tube benders and tube elevators, stylets to alter the curvature of the ET tube, stylets to act as guides for the ET tube, etc. Each one had merit, but the problems still remained.

## DESCRIPTION OF THE PRIOR ART

Several intubating airways were compared with the present invention. They include the English DIVIDED AIRWAY, the Williams AIRWAY INTUBATOR, and The Berman INTUBATING PHARYNGEAL AIRWAY. Although each is a useful aid in tracheal intubation, none has the built-in capacity to ventilate the patient, especially the hypoventilating or apneic patient, that the present invention demonstrates. Nor do they have any positive airseal mechanism to prevent leakage of gases and vapors during fiberoptic laryngoscopy/-bronchoscopy and tracheal intubation as has the present device.

The present invention is thinner than the above airways and is thus easier to insert into the oral cavity especially where jaw mobility is limited. In addition, the present invention has a better effective depth than the above airways, having a depth-adjustability range of more than 20mm from the highest to the lowest positions of the oral airway in reference to the oral mask. In exceptionally deep oral cavities some of the above airways had to be placed inside the lips in order to reach a functionally effective depth.